CALCULUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

PROBLEMS.

7. Proposed by Professor J. F. W. SCHEFFER, A. M., Hagerstown, Maryland.

To determine the function $F(x)$ so that $F(x+y)\times F(x-y)=[F(x)]^2-[F(y)]^2$.

8. A woodman fells a tree 2 feet in diameter, cutting half way through from each side. The lower face of each cut is horizontal, and the upper face makes an angle of 45° with the horizontal. How much wood does he cut out?

[Selected from *Byerly's Integral Calculus.*]

9. Proposed by Professor G. B. M. ZERR. A. M., Principal of Schools, Staunton, Virginia.

The solids bounded by the surfaces whose equations are $\left|\frac{x}{a}\right|^{\frac{2}{3}}+\left|\frac{y}{b}\right|^{\frac{2}{3}}+\left|\frac{z}{c}\right|^{\frac{2}{3}}=1$, and $x^{\frac{2}{3}}+y^{\frac{2}{3}}+z^{\frac{2}{3}}=b^{\frac{2}{3}}$ where $a>b>c$ have their centers coincident. Find (1 and 2) the volume of each without the other, and (3) the volume common to both by direct integration, using the formula $V=\int\int\int dxdydz$.

10 Proposed by ERIC DOOLITTLE, Instructor in Mathematics, State University of Iowa.

Prove or disprove the following theorem: If O be any circle, and AB any straight line either within or without the circumference, and if a perpendicular be dropped from O upon AB and prolonged backward to meet the circumference in P, *then* will the angle whose vertex lies at P and whose sides pass through A and B, cut a portion CPD from the circle which shall be greater than that cut by any other angle whose vertex lies on the circumference and whose sides pass through A and B.

[If any one can give a solution without the use of the Calculus, it will also be acceptable —ED.]

11. Proposed by H. W. DRAUGHON, Clinton, Louisiana.

A ribbon, 1 inch wide is wrapped spirally around a right prism, altitude 10 ft., bases of n sides, radius of circumscribed circle, 1 ft., so as to cover the entire convex surface. (1) What is the length of the ribbon? (2) If the ribbon is unwound and kept tense, by a power acting on the lower end, and moving in the plane of the lower base, what will be the length of the curve described by the power?

MECHANICS.

Conducted by B. F. FINKEL, Kidder, Missouri. All contributions to this department should be sent to him.

PROBLEMS.

6. Proposed by THOMAS W. WRIGHT, M. A., Ph. D., Professor of Applied Mathematics and Physics, Union College, Schenectady, New York.

What is the effect of a charge between light and heavy cavalry, the light cavalry having the greater energy and the heavy the greater momentum?

7. Proposed by DE VOLSON WOOD, M. A., M. Sc., C. E., Professor of Engineering, Stevens Institute of Technology, Hoboken, New Jersey.

A hollow sphere filled with frictionless water rolls down a rough plane whose length is l and inclination θ; when half way down the water suddenly freezes and adheres to the sphere. Required the time of the descent.

8. Proposed by ALFRED HUME, C. E., D. Sc., Professor of Mathematics in the University of Mississippi.

A heavy bar AB of length a falls about its lower end B from a vertical to a horizontal position, when the end A is suddenly fixed and B is set free, so that the bar falls into a vertical position AB as at first; then A is set free, and B is fixed, so that the bar again falls about B into a horizontal position, when the end A is suddenly fixed, and B is set free, and so on; find the angular velocity ω of the bar about the upper end, when it takes a vertical position for the nth time.

[Selected from *Price's Infinitesimal Calculus.*]

SOLUTION TO THE CELEBRATED INDETERMINATE EQUATION.

$$x^2 - Ny^2 = \pm 1.$$

To obtain the values of x and y, in integers, without taking the square root of N, by continued fractions. On account of requiring a certain class of non-quadrate numbers for N, to satisfy the -1, and causing more or less confusion, this part is set aside for future time. The $+1$ is found in all values of N, and our equation becomes $x^2 = Ny^2 + 1$.

Then $Ny^2 + 1 = \square = \left\{ \frac{mNy}{n} - 1 \right\}^2$ when reduced easily gives

$$y = \frac{2mn}{m^2 N - n^2}, \text{ and } x = \frac{mNy}{n} - 1, \ldots\ldots (A)$$

Let $\frac{m}{n} = \frac{1}{2}$, then $y = \frac{4}{N-4}$. Let $N = 2, 3, \square, 5, 6, 8, \square$

then $y =$	2	4	4	2	1	
$x =$	3	7	9	5	3	

$\frac{m}{n} = \frac{1}{3}$, and $y = \frac{6}{N-9}$,

$N = 3, 7, 8, 10, 11, 12, (13),$

$y =$	1	3	6	6	3	2
$x =$	2	8	17	19	10	7

$\frac{m}{n} = \frac{1}{4}$, and $y = \frac{8}{N-16}$,

$N = 14, 15, \square, 17, 18, (19), 20,$

$y =$	4	8		8	4	2,
$x =$	15	31		33	17	9

$\frac{m}{n} = \frac{1}{5}$, $y = \frac{10}{N-25}$,

$N = 15, (21), (22), 23, 24, \square, 26, 27, (28), (29), 30,$

$y =$	1			5	10		10	5		2
$x =$	4			24	49		51	26		11

$\frac{m}{n} = \frac{1}{6}$, $y = \frac{12}{N-36}$,

$N = 24, (31), 32, 33, 34, 35, \square, 37, 38, 39, 40, (41), 42,$

$y =$	1		3	4	6	12		12	6	4	3	2
$x =$	5		17	23	35	71		73	37	25	19	13